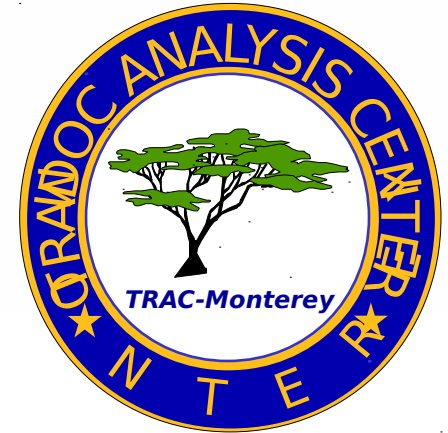# US Army Training and Doctrine Command Analysis Center - Monterey

**LTC Jeffrey Schamburg
Director**
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**TRAC-Monterey
PO Box 8695
Monterey, CA 93943-0695
DSN 756-3088, Com (831) 656-3088
Fax (831) 656-3084
https://www.trac.nps.navy.mil**

Introduction

- **Purpose: To give a brief overview of the TRAC-Monterey organization and to present our current research areas for potential project collaboration.**

- **Agenda.**
    - **TRADOC and TRADOC Analysis Center background.**
    - **TRAC-Monterey mission.**
    - **TRAC-Monterey FY06 projects.**

TRAC Mission

Provide relevant, credible analysis
to inform decision-making.

Support TRADOC Mission

TRADOC Mission

- **Recruit, Train & Educate the Army's soldiers.**
- **Develop Leaders.**
- **Support Training in Units.**
- **Develop Doctrine.**
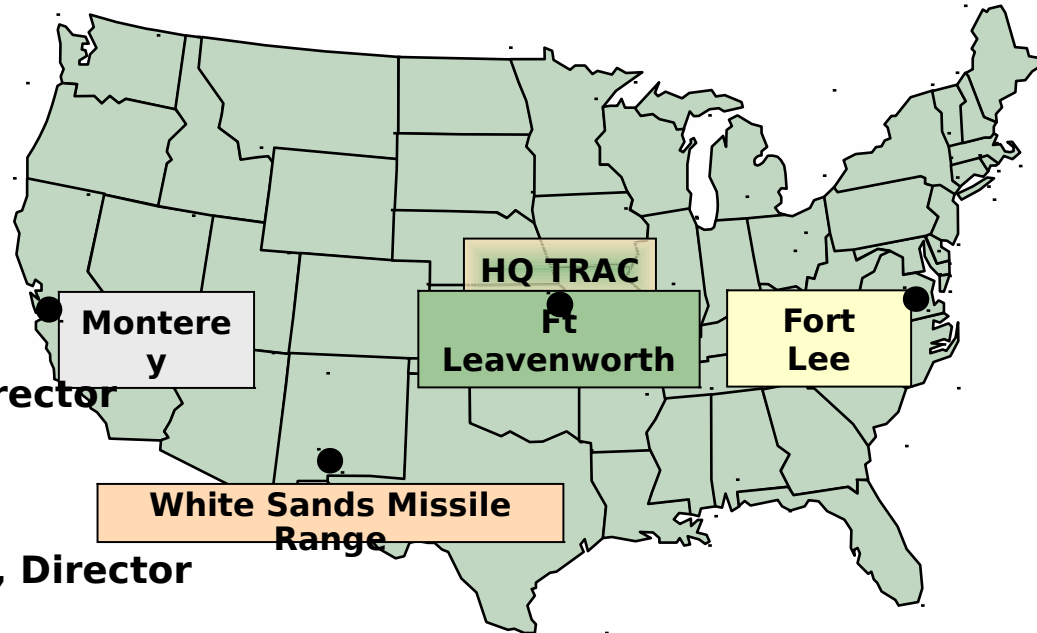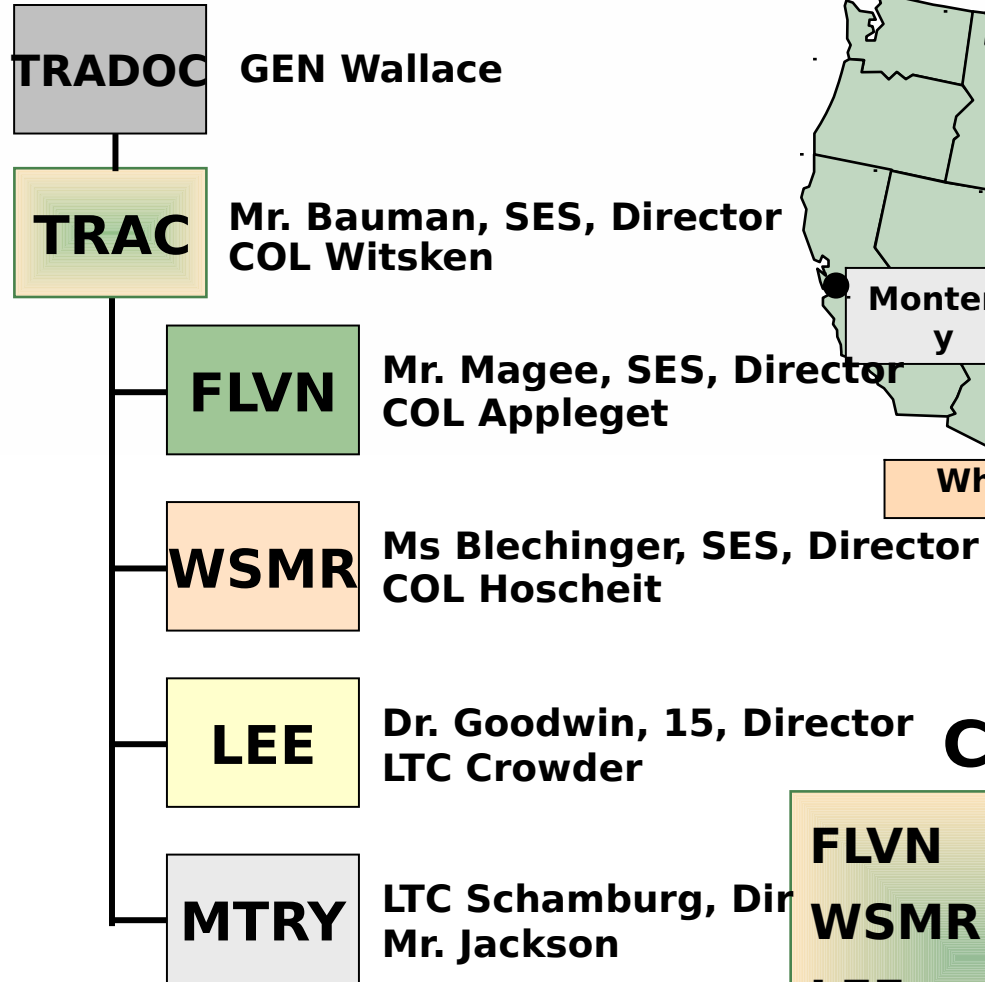- **Establish Standards.**
- **Build The Future Army.**

Futures Mission

- Design, develop & integrate all aspects of the Future Force
- Develop & integrate Joint and Army concepts & DOTMLPF capabilities.
- Validate S&T priorities.
- Lead future force experimentation.
- Synch and integrate Army capabilities with JIM capabilities.

TRAC Mission Essential Task List (METL)

- **Conduct studies & analyses that inform key decisions made by TRADOC, Army, and Joint leaders.**
- **Lead analysis for major Army experiments.**
- **Develop scenarios to underpin Army Transformation.**
- **Develop, configuration manage and apply verified and validated M&S.**
- **Research battlefield phenomenology to improve modeling & analysis.**

S&T: Science & Technology   JIM: Joint, Inter-agency and Multi-national   M&S: Models & Simulations

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TRAC Organization

TRADOC — GEN Wallace

TRAC — Mr. Bauman, SES, Director
COL Witsken

FLVN — Mr. Magee, SES, Director
COL Appleget

WSMR — Ms Blechinger, SES, Director
COL Hoscheit

LEE — Dr. Goodwin, 15, Director
LTC Crowder

MTRY — LTC Schamburg, Dir
Mr. Jackson

Monterey

HQ TRAC
Ft Leavenworth

Fort Lee

White Sands Missile Range

Centers of Expertise

FLVN   Div/Corps & Higher Ops

WSMR   Individual Soldier to BCT Ops

LEE   Maneuver Sustainment

MTRY   Research
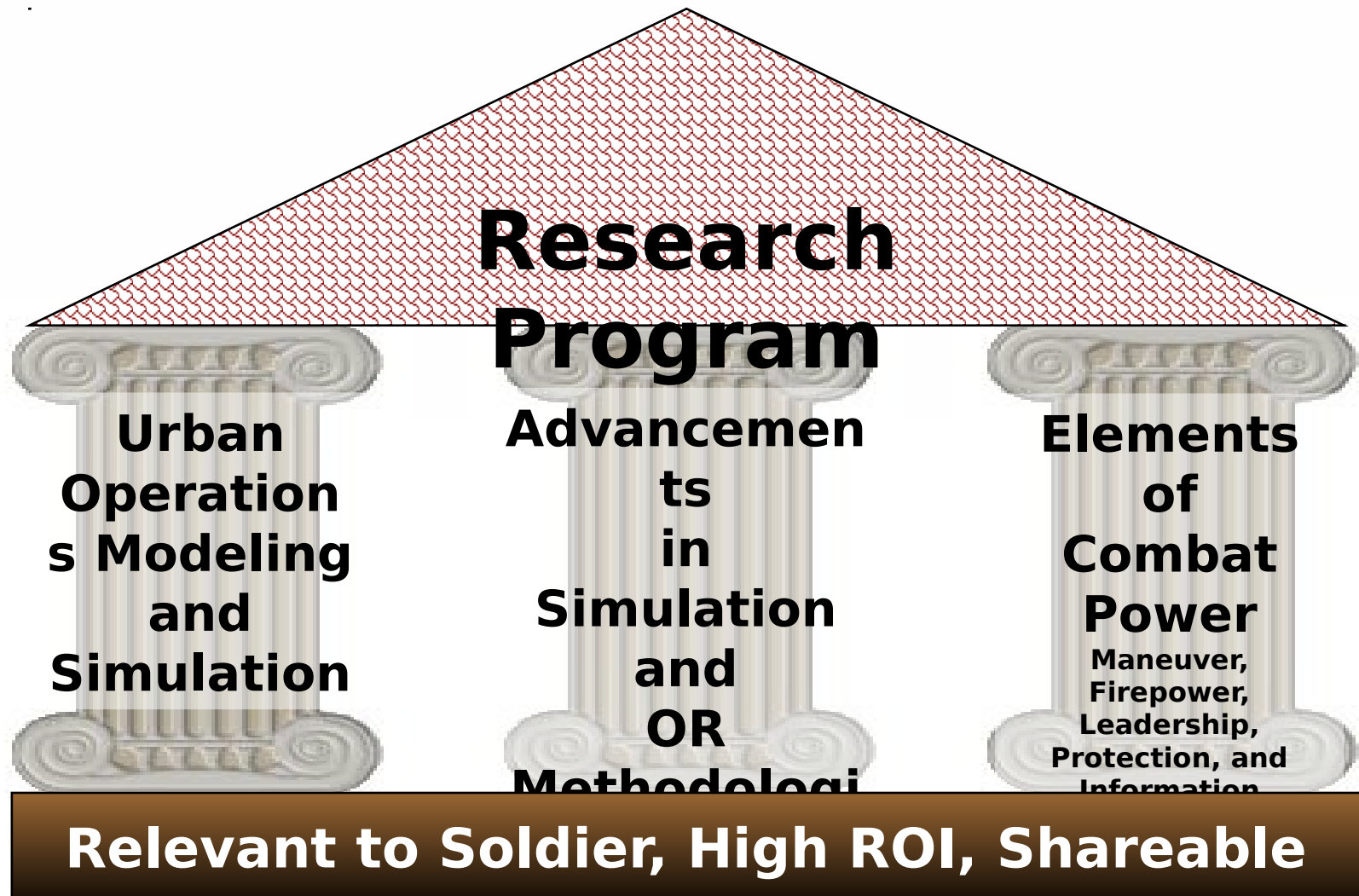
TRAC-Monterey Mission and Vision

Mission
Perform relevant and credible exploratory and applied research to support the TRAC mission.

Vision
TRAC-Monterey is recognized as a premier applied research organization for military modeling, simulation, methodologies, and analysis.

Our work will be relevant, credible, and user focused.

TRAC-Monterey Research Imperatives

Research Program

Urban Operations Modeling and Simulation

Advancements in Simulation and OR Methodologi

Elements of Combat Power

Maneuver, Firepower, Leadership, Protection, and Information

Relevant to Soldier, High ROI, Shareable

TRAC-Monterey Organization

Director

LTC Schamburg

ERDC Liaison

Ms. Turnage

Deputy

Mr. Jackson

Operations Research Analysts

MAJ Ahner	MAJ Willis
MAJ Tollefson	MAJ Van Alstine
Mr. Ruck	Mr. Yamauchi
MAJ Spainhour	

Administrative Staff

Secretary/Admin – Ms. Lackey

System Administrator – SGT Turner

Personnel Background

LTC Jeff Schamburg	**PhD Systems Eng – University of Virginia**
Mr. Jack Jackson	**MS Ops Research – Naval Postgraduate School**
Ms. Doris Turnage	**PhD (ABD) CS – University of Mississippi**
MAJ Darryl Ahner	**PhD Systems Eng – Boston University**
MAJ Eric Tollefson	**MS Ops Research – Georgia Tech**
MAJ Aaron VanAlstine	**MPA - N. Michigan University**
MAJ Rich Spainhour	**MS Ops Research – Colorado School of Mines**
MAJ John Willis	**MS Systems Eng – University of Virginia**
Mr. John Ruck	**MS Ops Research – Naval Postgraduate School**
Mr. Harold Yamauchi	**MS Ops Research – Oregon State University**

TRAC-Monterey Partnerships

Military

- Army G3 Battle Command Simulation and Experimentation (BCSE) Directorate
- Engineer Research and Development Center
- Army Infantry Center
- PEO Soldier
- TPO OneSAF / PM OneSAF
- TPO Future Force Warrior
- DARPA
- Army Material Systems Analysis Activity (AMSAA)
- Army Aviation and Missile Defense Command
- Army Aviation Center
- Army Depth & Simultaneous Attack Battle Lab
- Army Simulation, Training, and Instrumentation Command
- Air Force Training and Evaluation Command
- Army Accessions Command
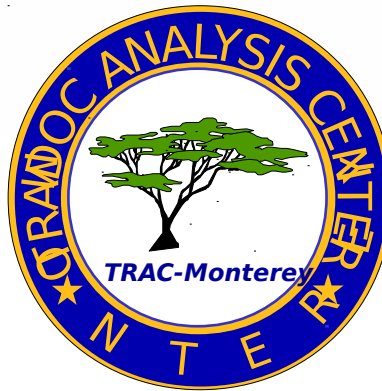
Academia

NPS:
- Computer Science
- Engineering Management
- Mathematics
- Mechanical Engineering
- MOVES
- Operations Analysis
- Software Engineering
- Systems Engineering

USMA
- Systems Engineering

Contractors

- Rolands and Associates, Inc.
- Dynamics Research Corporation
- Tapestry Solutions, Inc.
- NovaLogic Systems
- Wexford Group

TRAC-Monterey

Combat Modeling Lab

- **Models**
  - **IWARS**
  - **COMBATXXI**
  - **OneSAF Objective System (OOS)**
  - **JCATS**
  - **Janus**
  - **EPiCS**

- **Agent Based Models**
  - **Pythagoras**
  - **MANA**

- **Others**
  - **As necessary**

- **Research**
  - **TRAC Analysts**
  - **Faculty Partners**
  - **Student Thesis**

- **Education**
  - **Lab Tours**
  - **Open Houses**
  - **Class Projects**

Project Topic Characteristics

- **Importance to the Soldier.**

- **Importance to the Army and Joint communities.**

- **TRAC mission related.**
  - **TRAC-Monterey Mission: Perform relevant and credible exploratory and applied research to support the TRAC mission.**

- **An Army client with demonstrated interest.**

- **Professor interest and involvement.**

Benefits to the Student

- **Relevant contribution to the Army and Joint communities.**

- **Possible support for research trips, technical resources, technical support, and other needs.**

- **Labs and conference areas.**
    - **Traditional simulation models (OneSAF, IWARS, Combat^{XXI}, Janus, JCATS).**
    - **Agent-based models (Pythagoras, MANA).**
    - **Others as appropriate.**

- **Subject matter experts (SMEs) that are both formal and informal.**

- **Source of networked experts external to Monterey.**

- **Source for sharing your work w/ those who need it.**

Sample of Current and Recent NPS Thesis Projects

NPS Student	Rank	Degree	Thesis
Alt	MAJ, USA	MSOR	Exploring Tactics, Techniques And Procedures for a Future Force Warrior Small Combat Unit
Burnett	Civ	PhD, OR	Personality and Cultural Effects on Team Effectiveness in Joint, Interagency and Multi-National Operations
Collaco	LT, USN	MSOR	Measuring Situational Awareness for Individual Combatants
Ellis	MAJ, USA	MSCS	Human Behavior Representation of Military Teamwork (w/ Martin)
Grimes	MAJ, USA	MSOR	Individual Combatant Reaction to Sound as a Non-Lethal Weapon in Combat XXI
Jones	MAJ, USA	MSCS	Games for Training (w/Nolan)
Sulewski	CPT, USA	MSOR	An Exploration of Unmanned Aerial Vehicles in the Army's Future Combat System Family of Systems
Kramlich	CPT, USA	MSOR	Effect of Survivability Equipment on Combat Rifleman Lethality

Sample of Current and Recent NPS Thesis Projects

NPS Student	Rank	Degree	Thesis
Kunde	ObrstLtnt, GER	PhD, OR	Event Prediction for Modeling Mental Simulation in Naturalistic Decision Making
Martin	CPT, USA	MSCS	Human Behavior Representation of Military Teamwork (w/ Ellis)
Michaud	CPT, USA	MSOR	Sound Localization for Computer Generated Individual Combatants
Nolan	MAJ, USA	MSCS	Games for Training (w/ Jones)
Richardson	Capt, USMC	MSOR	Distributed Capabilities of the Future Force Warrior Small Combat Unit
Takagi	Capt, USMC	MSOR	Effects of Tacticomps/Tactical PDAs on Small Unit SA/C4ISR
Wittwer	MAJ, USA	MSOR	Non Lethal Weapons for the Future Force Warrior Small Combat Unit
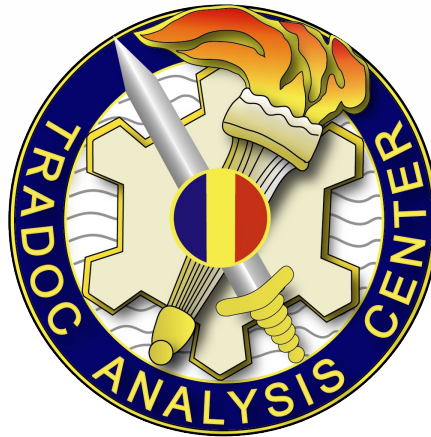
TRAC-Monterey Current FY06 Research

Support to Rapid Equipping Force (REF)

Project Description: REF lacks standard procedures for systems engineering and management in the analysis of potential acquisition products. Purpose is to:

– Provide modeling, simulation, and analysis support to the REF.

– Develop generalized REF analysis and implementation methodology and supports the training of REF personnel on the developed methodology.

Technical Approach:

– Develop REF Analysis Methodology.

– Demonstrate Application of the Developed Analysis Methodology (Analysis).

– Assess Impact of REF-Delivered Capabilities.

Sponsor: REF

Partners: TRAC

• **Current REF Systems:**
- **Packbot**
- **PocketTerp**
- **Magnetometer**
- **Lock Shim**
- **Wellcam**
- **Armor Kit**
- **PILAR**

General Research Topic:
Alternative comparison, distribution plan, assessment and analysis of systems (e.g. PocketTerp) for the Rapid Equipping Force

PocketTerp Concept:

iPaq modification allows user to prerecord translations for specific phases with voice print recorded that can be recalled

System can be programmed to hold hundreds of phrases

Reprogram-able in the field

System can be used for other functions as well as a translator.

Modified to hook up to speaker system

Weight: <1 lb

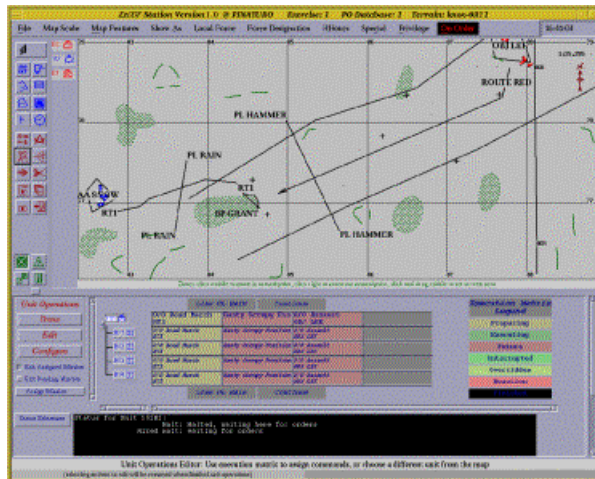# Multi-Purpose Enterprise Simulation Suite (MPESS)

Project Description: The vision for MPESS is on independent and replaceable models that move from various levels of fidelity and resolution reflective of the situation and players. Technical solutions will be robust, interoperable, reusable and in synchronization with current Battle Command, operations-to-intelligence initiatives, and M&S programs.

Technical Approach:

- Create core infrastructure concepts for scenario development, execution and AAR.
- Assist development and PoP demonstration of the MPESS CRM.
- Outline requirements for conceptual and data exchange models (e.g. C2IEDM).

Sponsor: BCSE

Partners: DARPA "Big Worlds", REF, JIED TF.

General Research Topic:

Development of concepts and alternatives for a Multi-Purpose Enterprise Simulation Suite(s) (MPESS).

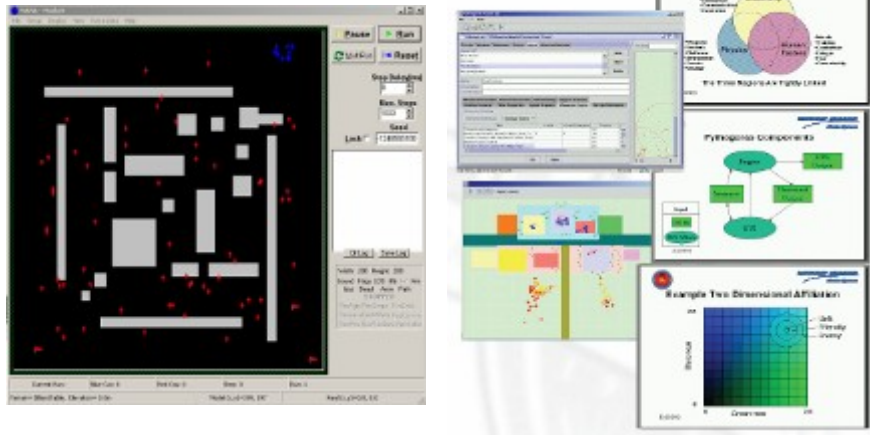**Initial focus will be IED Training Simulation.**

Modeling Close Range, Quick Reaction Engagements

Project Description: Investigation of the critical factors required to model Soldier activities in close range and quick reaction engagements; identification and modeling of TTPs for such engagements; development of algorithms to represent close range and quick reaction engagements.

Provides the foundation for future modeling and data collection efforts.

Technical Approach: Within framework of Systems Engineering and Management Process (SEMP); extensive research and SME interviews; use of ABMs in the context of value modeling to identify critical factors; creation of simulation algorithms for TTPs, extensive SME input throughout process.

Sponsor: Soldier FACT

Partners: TBD

MANA (left) and Pythagoras (right), agent based simulations, can be used to run a large number of scenarios quickly.

General Research Topic:

Identification and analysis of the factors that impact the individual combatant in close quarters and quick reaction engagements.

Future Force Warrior (FFW) Capabilities Analysis

Project Description: Investigation of potential TTPs and distributed capabilities through subject matter experts (SMEs) and modeling and simulation (M&S).

   The FFW program needs an analytical methodology to evaluate TTPs and to tweak them as a result of that analysis, as well as an analytical methodology to determine the optimal distribution of potential FFW capabilities.

Technical Approach: Within framework of Systems Engineering and Management Process (SEMP); extensive research and SME interviews; value modeling to capture stakeholder preferences and MOEs; experimental design to test potential capability distributions/TTPs; experiments run in simulation, including ABMs, to determine optimal distributions and TTPs; recommend distributions/TTPs.

Sponsor: PM FFW

Partners: TBD

MANA (agent based simulation) and IWARS screenshots showing potential models for analysis.

General Research Topics:

• Capabilities: analyze the proposed FFW system and compare it with the current soldier and the Land Warrior system.

• Basis of Issue (BOI): analyze the distribution of potential FFW capabilities to the members of the small combat unit.

• TTPs: analyze the effects of proposed FFW capabilities on TTPs.
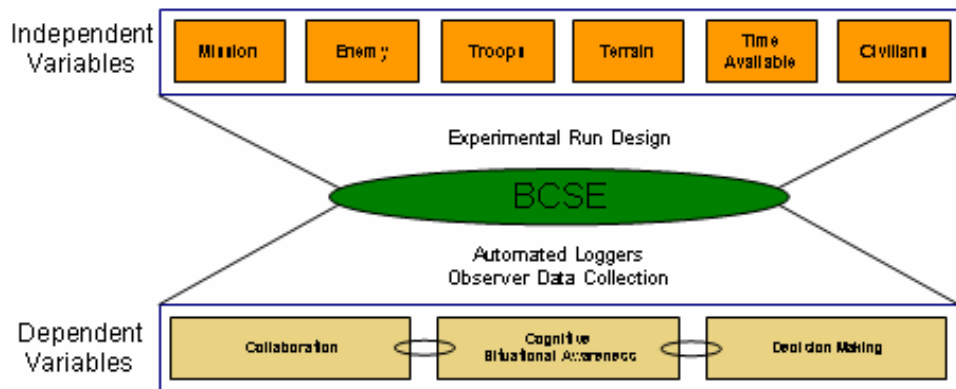
• Other: training, facilities, logistical issues.

DARPA M&D C2 Experiment 7

Project Description: Spiral develop a multi-echelon, knowledge-based reasoning enhanced, command and control (C2) model of a "net-centric" battle command system. Through experimental investigations, which measure the effectiveness of its integrated battle command functions, inform the future force with the "Quality of Firsts" providing Commanders the decisive edge.

Technical Approach: Serve as core analytical team member and lead analyst for decision making EEA.

Sponsor: DARPA & PEO STRI.

Partners: MITRE, TRAC, ARA.

Experimental Methodology linking the battle command prototype, collaboration, situation awareness and decision making.

General Research Topic:

Analysis of Battle Command Experimentation.

- TRAC has access to data (audio, video, ground truth, etc.) from a series of DARPA battle command experiments with a notional future force using a futuristic battle command prototype against a thinking enemy in a contemporary operating environment.

- There are a variety of potential project topics involving situation awareness, decision-making, collaboration and related battle command topics. Issues might involve ISR, BDA, effects, information, etc.

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UAV Mix Tool Development And Analysis

Project Description: The first phase is the UAV Mix Tool development. The UAV Mix Tool takes output from a simulation and determines the number of missions that can be performed. Output consists of a schedule for each UAV in the scenario. Follow on phases consist of UAV sensor selection, a design of experiments generator, and appropriate UAV simulation tools.

Technical Approach: A two pronged approach: Continue development of an analysis tool using OPL Studio. Develop an exportable tool through teaming with NPS faculty.

Sponsor: TRAC-HQ.

Partners: NPS

Current and future capabilities impact the types and locations of UAVs needed to satisfy the Aerial CBA mission areas.

General Research Topic:
UAV Mix Tool Development:
What characteristics of the combat system should be modeled and how?
What are the critical questions to be answered and what measures of performance enable analysis to answer these questions?
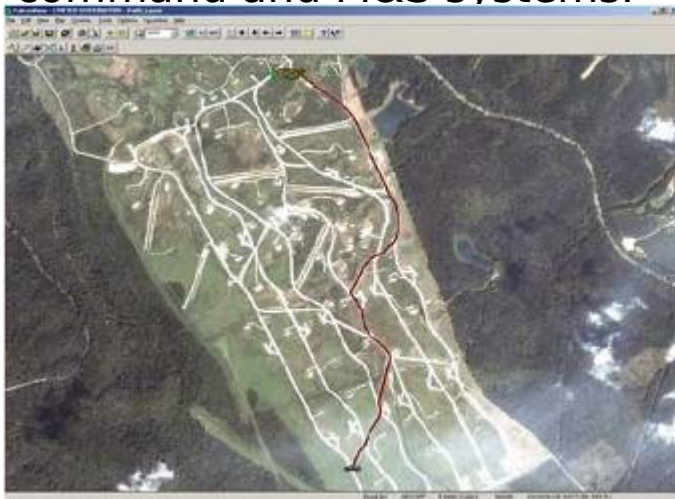
UAV Mix Analysis:
Analysis of unmanned aerial vehicle (UAV) mix alternatives for the Army.

14 Februa

Unmanned Ground Vehicle Navigation: Image Analysis, M&S, and On-Board Guidance

Project Description: UGV navigation is highly dependent on the perception of underlying terrain. Purpose is to use real-time/near-real-time remote sensing imagery to build /enhance an M&S terrain data set to allow autonomous on-board navigation of military UGVs. The effort also seeks to automate the process of network generation for insertion into battle command and M&S systems.

Technical Approach: Employ object-based extraction techniques to interpret multi-spectral high-res imagery / LADAR data, develop a maneuver network, conduct route planning, and demonstrate ability of UGV to follow network coupled with on-board sensors.

Sponsor: Nat. Center for Defense Robotics

Partners: ERDC, TARDEC, R&A Corp.

Satellite imagery and LADAR data used to generate feature map and arc-node network for routing calculations.

General Research Topics:

- Analysis of the requirements and alternatives for automating the process of network generation for insertion into battle command and M&S systems.
- Analysis of the requirements and alternatives for autonomous, on-board navigation of unmanned ground vehicles (UGVs).

Developing Commander to Sensor Metrics

Project Description: Currently, sensors are placed on the battlespace according to predefined templates dictated by guesses of information needs. Data is sometimes fused into information but information seldom is fused into the required knowledge to answer the commander's operational questions. Sensor data is numerous and is pushed to systems throughout the battlespace.

Technical Approach: Develop metrics and human interfaces that allow information to be pulled to answer the commander's questions. Metrics should identify holes in the sensor data available so that new sensor placement requirements will result.

Sponsor: ARO.

Partners: NPS.

Dynamic Model of Sensor Fusion and Situated Cognition
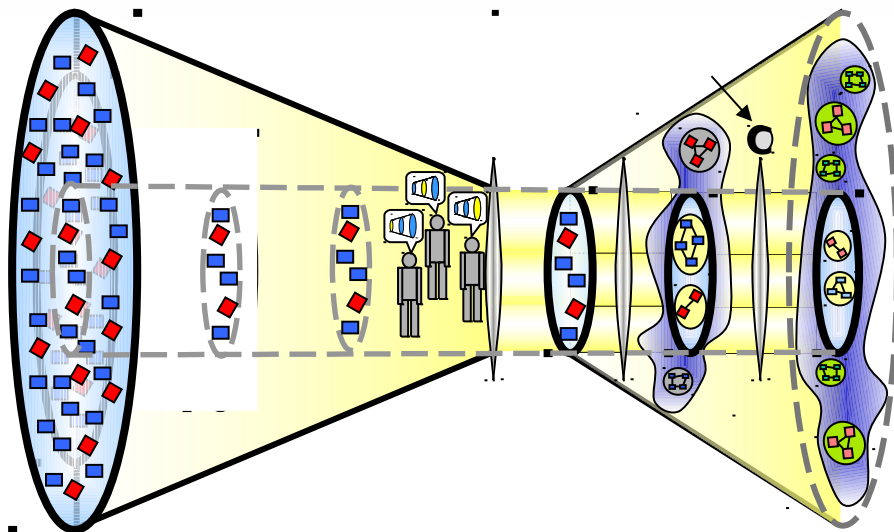
General Research Topics:

• Develop metrics and human interfaces that allow information to be pulled to answer the commander's questions.

• Analyze and develop methods to determine and display sensor coverage, and to plan and control organic sensors effectively as part of layered ISR.

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Dynamic Sustainment for Battle Command Analysis

Project Description: Dynamic Sustainment is a maintenance model that can run either as a stand-alone module or can be linked to an entity-level combat simulation. It will inform the analysis process for studies of future systems. This model is successful when it is implemented with a simulation such as COMBAT[21].

Technical Approach: Develop a discrete-event maintenance simulation using Simkit as the simulation engine. Implement model so it is capable of dynamically modeling sustainment in a simulation such as COMBAT[21].

Sponsor: Log FACT, G3

Input from: TRAC-LEE, TRAC-WSMR, AMSAA, & CASCOM

Dynamic Sustainment will address maintenance and CL IX issues

General Research Topics:

Modeling the maintenance requirements for combat systems.

Simulating maintenance in various combat scenarios.

Logistics Battle Command Model

Project Description: The LBC model will be developed with and for TRAC- LEE and it will build upon capabilities developed for Dynamic Sustainment. The LBC model will dynamically forecast and represent demand for supplies in a simulation such as COMBAT[21]. Priority of effort is Class III, V, and I. The LBC model also represents the distribution network including nodes (storage, maintenance, supply, medical and field services) and arcs (modes of transport).

Technical Approach: Capitalize on capabilities developed with TRAC-LEE and WSMR during the Dynamic Sustainment modeling effort. Develop a model that collects OPTEMPO and demand data from a combat simulation such as COMBAT[21] and inject sustainment results back into the simulation. It can also connect to an aggregate simulation to estimate logistical demands and provide more detailed analysis of major operations.
Sponsor: LOG FACT, G3 (Proposed)
Input from: TRAC-LEE, TRAC-WSMR, AMSAA, & CASCOM

LBC will work with a simulation such as COMBAT[21]

General Research Topic:

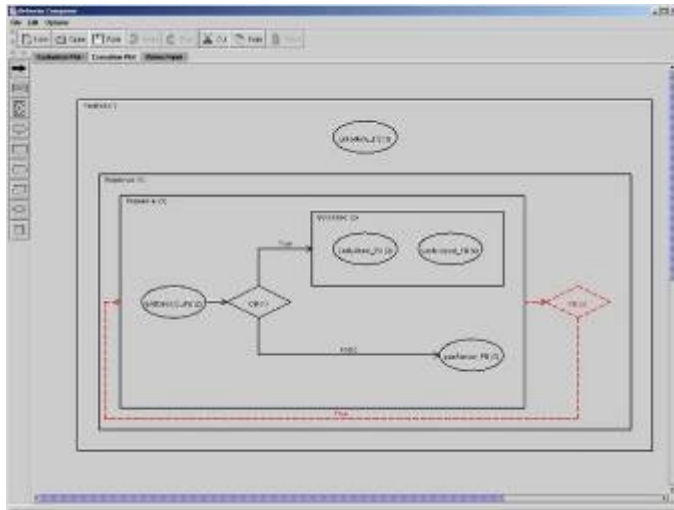Forecasting and representing demand for parts and supplies within a combat simulation.

OneSAF Objective System (OOS) Behavior Model Analysis

Project Description: Verification of OOS Block D (FOC) composite behaviors. OOS has created a set of core composite behaviors to model common entity and unit missions. Has tremendous implications on the suitability of OOS for analysis. Next step will consist of determining the robustness of modeled behaviors for use in analyses, as part of TRAC-WSMR effort.

Technical Approach: Develop and execute methodology to verify composite behaviors within OOS; ensure methodology is analytically sound and well-documented; determine behavior modeling requirements for use in analyses and measures of merit (MOMs); compare OOS behavior models against req'ts.

Sponsor: PM OneSAF

Partners: TRAC-WSMR

OOS Behavior Composer interface demonstrating the creation of composite behaviors from other composites and primitives.
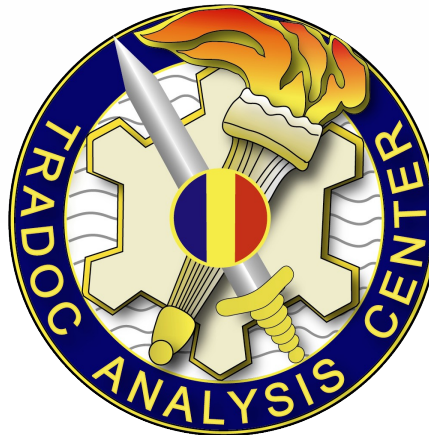
General Research Topic:

Analysis of the available behavior models (OOS, Combat^{XXI}, IWARS) to determine their suitability for use in analysis. Should include:

- Identification of the minimum set of behaviors required to represent the current and future forces.

- Prioritization of the set of behaviors based upon analysis requirements.

TRAC-Monterey Potential Thesis Topics

NPS Research Topics
(Future Soldier & Small Combat Unit Systems)

1. Comparison and analysis of potential tactics, techniques, and procedures (TTPs) for Future Force Warrior (FFW) capabilities.

2. Comparison and analysis of potential distributed FFW capabilities.

3. Development of data and algorithms for weapon accuracy and effects in close range and quick reaction engagements.

4. Comparison and analysis of tactics, techniques, and procedures (TTPs) for close range and quick reaction engagements.

5. Analyze the potential effects on small unit (infantry) organization (i.e., squad and company unit size and composition) due to the development of potential FCS and FFW technologies.

6. Analyze the methods of presentation for situational awareness information and the effects of cognitive overload on soldier effectiveness.

7. Analyze Soldier concentration/attentiveness/focus and the unique manner in which Soldiers must quickly process information in the close-range, quick reaction environment characteristic of urban engagements.

8. Analyze the physiological effects of the proposed FFW ensemble on Soldier task performance.

NPS Research Topics
(Department of Homeland Security & the National Exercise Program)

1. Simulation modeling and analysis of National Exercise Program scenarios.

2. Development of war gamming capabilities and methods to support the National Exercise Program.

3. Exploring the benefits of simulation tools for the National Exercise Program.

4. Exploring guidelines for effective preparedness for emergencies at the local and state level based on the national response plan.

5. Exercises for effective communications during emergencies at the local and state level.

NPS Research Topics
(Logistical Modeling & Analysis)

1. Optimizing inventory of CL IX and mechanics for a BCT in full-spectrum operations.

2. Modeling and analysis of execution of maintenance operations in an urban battlefield environment.

3. Link logistics to operational plans (algorithms and models).

4. A comparative logistical analysis using Dynamic Sustainment (a recently developed logistical simulation tool) and a legacy model.

NPS Research Topics
(UAV, UGV, and Sensor Modeling & Analysis)

1. Development of a UAV Mix Analysis Tool.

2. Design of an Experimental Design Tool for UAV Mix Analysis.

3. Comparative analyses of UAV Mix alternatives.

4. Developing Commander to Sensor Metrics.

5. Determination of Sensor Coverage using a low Resolution Simulation.

6. Unmanned Ground Vehicle (UGV) Navigation: Image Analysis, Modeling and Simulation, and On-Board Guidance.

NPS Research Topics
(Command and Control)

1. Fighting the Counter Recon Fight in the Future Force. Gaining an information advantage includes defeating enemy reconnaissance; however, we do not know how this is best accomplished in a future lightweight network enabled force.

2. Managing Sensor Assets in the Future Force. A small, lightweight network enabled force must manage sensors well and understand sensor coverage capabilities and gaps; however, we lack methods to determine and display sensor coverage, and to plan and control organic sensors effectively as part of layered ISR.

3. Conduct analysis using resulting data and feedback from multi-cell and dismounted C2 experiments.

4. Support or participate in multi-cell and dismounted C2 experiments.

5. Development, improvement, and analysis of interfaces/displays for mobility data in battle command and embedded training systems.

NPS Research Topics
(Others)

1. Modeling, simulation, and analytical support of rapidly provided capabilities (e.g. "Railcar" for logistical operations) in support of deployed forces.

2. Assessment of rapidly provided capabilities in support of deployed forces.

3. Development of concept for Military Enterprise Simulation Suite(s) (ESS).

4. Development of Decision Support Metrics for Army Programs.

5. Investigate the validity of the OneSAF Objective System (OOS) behavior modeling framework.

6. Compare the behavior modeling frameworks of CombatXXI, the Infantry Warrior Simulation (IWARS), and the OneSAF Objective System (OOS) and assess their compatibility and consistency.

Contact Information

Name	Position	Projects	Phone
LTC Jeffrey Schamburg	Director	All	x3088
Mr. Jack Jackson	Deputy Director	All	X3087
MAJ Darryl Ahner	Analyst	UAV Mix Analysis Dynamic Allocation of Fires and Sensors	x7574
MAJ Eric Tollefson	Analyst	General Soldier Analysis Future Force Warrior Analysis OneSAF Behavior Modeling	x7578
Ms. Doris Turnage	ERDC Liaison	Department of Homeland Security National Exercise Program	x3732
MAJ Aaron VanAlstine	Analyst	Dynamic Sustainment Logistical Battle Command	x7575
MAJ John Willis	Analyst	Rapid Equipping Force Support Multi-Purpose Enterprise Simulation System	x7580

NOTE: TRAC employees are on the global email system.
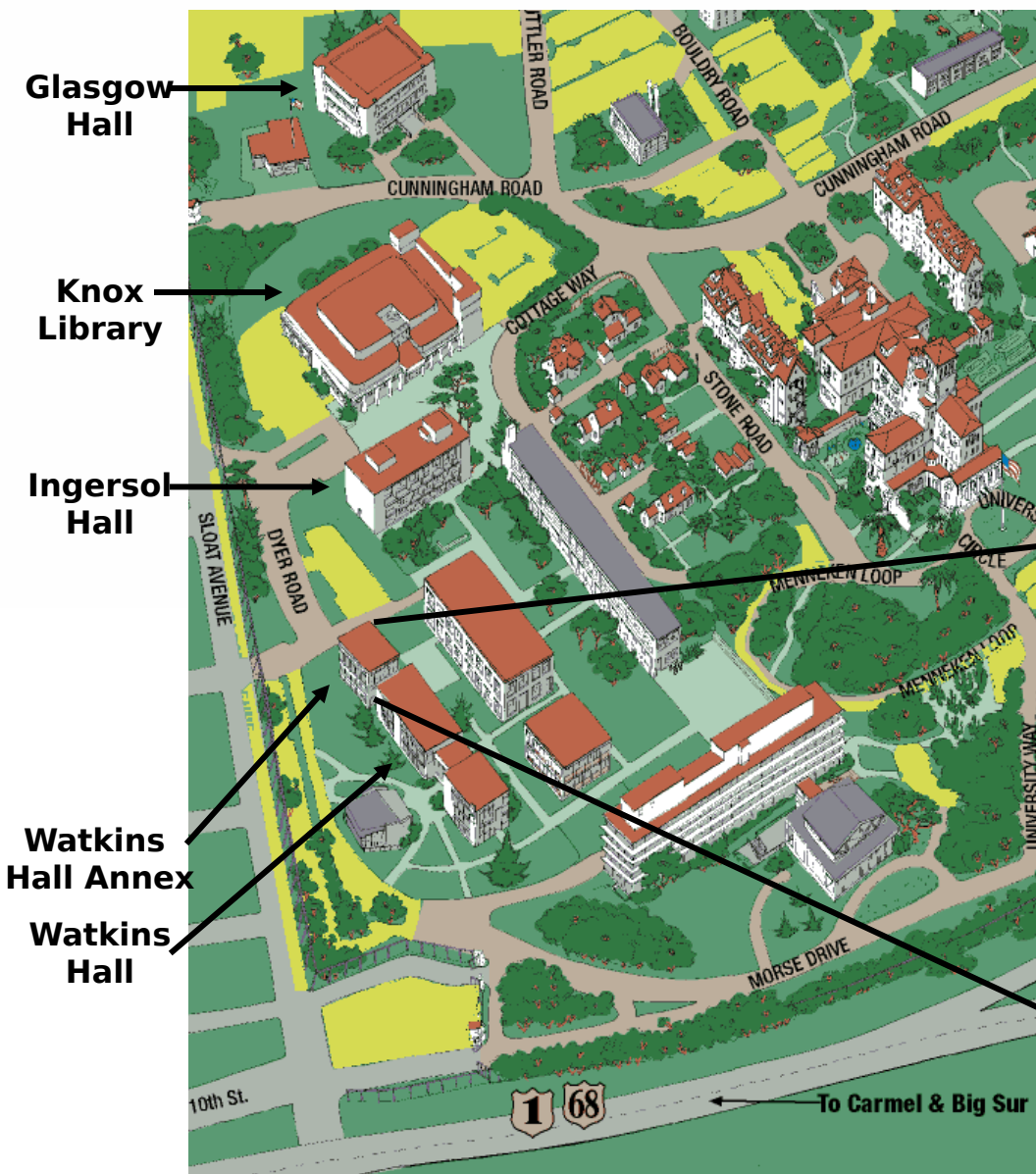
The TRADOC Analysis Center in Monterey (TRAC-MTRY) is located on the first floor of the Watkins Hall Annex. To get there, enter either the glass doors on the Sloat Ave side of Watkins Hall and then go left through the double doors or enter the single door on the Ingersol Hall (north) side of the building and go straight through the double doors. The floor plan is below: